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TOP QUARK PRODUCTION: SENSITIVITY TO NEW PHYSICS *

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ABSTRACT

The production cross–section and distributions of the top quark are sensitive to new physics, e.g., the $t\bar{t}$ system can be a probe of new resonances or gauge bosons that are strongly coupled to the top quark, in analogy to Drell–Yan production. The existence of such new physics is expected in dynamical electroweak symmetry breaking schemes, and associated with the large mass of the top quark. The total top production cross–section can be more than doubled, and distributions significantly distorted with a chosen scale of new physics of $\sim$ 1 TeV in the vector color singlet or octet s–channel. New resonance physics is most readily discernible in the high–p_T distributions of the single top quark, of the W boson and the mass distribution of the $t\bar{t}$ pair.

1. Summary

Top quark production at the Fermilab Tevatron probes very high mass scales, $\mathcal{O}(500\ GeV)$, and therefore is sensitive to new physics at this scale. Hence, it is important that we studied this process with high precision and compare the results with the standard model predictions. Hill and Parke [1] have studied the effects of new physics on top quark production in a general operator formalism as well as in topcolor models. In these models the distortions in top quark production and shape are due to new physics in the $q\bar{q}$ subprocess. Eichten and Lane [2] have studied the effects of multi-scale technicolor on top production through the production of a techni-eta resonance. Here the coupling of the techni-eta is to gg, therefore only this subprocess is different than the standard model. At the Fermilab Tevatron top production is dominated by $q\bar{q}$ annihilation while at the LHC it is the gg fusion subprocess that dominates. Therefore these models predict very different consequences for top production at the LHC.

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1. C. Hill and S. Parke, Phys. Rev. **D49** 4454, (1994).
2. E. Eichten and K. Lane, Phys. Lett. **B327** 129, (1994).

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